DESCRIPTION OF THE INVENTION

[0024] Referring now to **FIGS. 1 and 2** of the drawings, there is shown shaft support structure **2** according to the present invention, which includes an elongated shell **11** having substantially opposing sidewalls **26** and **27**, and base **28**. Elongated shell **11** has interior surfaces **14** which define a hollow interior **17**. More specifically, it is the interior surfaces of sidewalls **26**, **27** and base **28** that define hollow interior **17**. A plurality of reinforcing ribs **20** are located within the hollow interior **17** of elongated shell **11**. A portion **23** of reinforcing ribs **20** abuts interior surfaces **14** of elongated shell **11** (i.e., reinforcing ribs **20** are not continuous with shell **111**). Reinforcing ribs **20** define a longitudinal passage **41**, having a longitudinal axis **44**, through interior **17** of elongated shell **11**.

[0025] Reinforcing ribs **20** are depicted in **FIG. 1** as having an X-like configuration. It is to be understood that the scope of the present invention is inclusive of other configurations, e.g., curved or arc configurations and/or parallel configurations. In an embodiment of the present invention, reinforcing ribs **20** form of a series of parallel ribs, which abut internal surfaces **14** of shell **11**, and which have an open U-shaped configuration (not shown). The open portion of the U-shaped configuration of the reinforcing ribs is opposite of base **28**, and defines an open longitudinal passage (not shown) through the interior of the elongated shell of the shaft support structure.

[0026] Shaft support structure **2** also includes a first plastic reinforcing end plate **65** having an aperture **66** therein, and a second plastic reinforcing end plate **68** having an aperture **67** therein. Apertures **66** and **67** are substantially axially aligned with and serve to further define longitudinal passage **41**. End plates **65** and **68** are substantially opposed one from the other, and at least a portion of each abuts interior surfaces **14** of elongated shell **11**.

[0027] A rotatable shaft **47** is received in longitudinal passage **41**. Shaft **47** may be rotatably supported within longitudinal passage **41** by at least one of: (i) the reinforcing ribs **20**; (ii) bushings, e.g., plastic bushings, (not shown); and (iii) rolling bearing means. Aperture **66** of first end plate **65** has rolling bearing means **74** therein, which rotatably supports shaft **47**. Shaft support structure **2** may include additional rolling bearing means **74**, e.g., within longitudinal passage **41** and aperture **67** of second end plate **68**. Rolling bearing means that may be used in the present invention include those that are known to the skilled artisan, and typically include a housing, e.g., a plastic housing, and metal ball bearings (not shown) which engage rotatably with shaft **47**.

[0028] Elongated shell **11** of shaft support structure **2** may be fabricated from materials selected from metal, thermoset plastic material, thermoplastic material and combinations thereof. In a preferred embodiment of the present invention, elongated shell **11** is fabricated from metal. Metals from which shell **11** may be fabricated include, but are not limited to, ferrous alloys, aluminum alloys and titanium alloys.

[0029] As used herein and in the claims the term "thermoset plastic material" means plastic materials having a three dimensional cross-linked network resulting from the formation of covalent bonds between chemically reactive groups, e.g., active hydrogen groups and free isocyanate groups. Thermoset plastic materials from which elongated shell **11** may be fabricated include those known to the skilled artisan, e.g., cross-linked polyurethanes, crosslinked polyepoxides and crosslinked polyesters. Of the thermoset plastic materials, crosslinked polyurethanes are preferred. Shell **11** may be fabricated from crosslinked polyurethanes by the art-recognized process of reaction injection molding. Reaction injection molding typically involves, as is known to the skilled artisan, injecting separately, and preferably simultaneously, into a mold: (i) an active hydrogen functional component (e.g., a polyol and/or polyamine); and (ii) an isocyanate functional component (e.g., a diisocyanate such as toluene diisocyanate, and/or dimers and trimers of a diisocyanate such as toluene diisocyanate). The filled mold may optionally be heated to ensure and/or hasten complete reaction of the injected components. Upon complete reaction of the injected components, the mold is opened and the molded article, e.g., shell **11**, is removed.

[0030] As used herein and in the claims, the term "thermoplastic material" means a plastic material that has a softening or melting point, and is substantially free of a three dimensional crosslinked network resulting from the formation of covalent bonds between chemically reactive groups, e.g., active hydrogen groups and free isocyanate groups. Examples of thermoplastic materials from which elongated shell **11** may be fabricated include, but are not limited to, thermoplastic polyurethane, thermoplastic polyurea, thermoplastic polyimide, thermoplastic polyamide, thermoplastic polyamideimide, thermoplastic polyester, thermoplastic polycarbonate, thermoplastic polysulfone, thermoplastic polyketone, thermoplastic polypropylene, thermoplastic acrylonitrile-butadiene-styrene and mixtures or thermoplastic compositions containing one or more thereof. Of the thermoplastic materials from which shell **11** may be fabricated, thermoplastic polyamides are preferred. Shell **11** may be fabricated from thermoplastic materials by the art-recognized process of injection molding, in which a molten stream of thermoplastic material, e.g., molten thermoplastic polyamide, is injected into a mold, e.g., an optionally heated mold. Upon cooling the filled mold, the molded article, e.g., shell **11**, is removed. A preferred thermoplastic material from which shell **11** may be fabricated is thermoplastic polyamide, e.g., DURETHAN thermoplastic polyamide, commercially available from Bayer Corporation.

[0031] The thermoset plastic materials and/or thermoplastic materials from which shell **11** may be fabricated, may optionally be reinforced with a material selected from glass fibers, carbon fibers, boron fibers metal fibers and mixtures thereof. The reinforcing fibers, and the glass fibers in particular, may have sizings on their surfaces to improve miscibility and/or adhesion to the plastics into which they are incorporated, as is known to the skilled artisan. Glass fibers are a preferred reinforcing material in the present invention. If used, the reinforcement material, e.g., glass fibers, is typically present in the thermoset plastic materials and/or thermoplastic materials of elongated shell **11** in a reinforcing amount, e.g., in an amount of from **5** percent by weight to **60** percent by weight, based on the total weight of shell **11**.

[0032] The plastic material of reinforcing ribs **20** of shaft support structure **2** may be selected from thermoset plastic materials, thermoplastic materials and combinations thereof. The thermoset plastic materials from which reinforcing ribs